ISD Guidelines for the WBS

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Purpose

The purpose of this document is to provide uniform guidance for developing the ISD mission software project's Work Breakdown Structure (WBS), which is a mechanism used to formulate the project plan, report progress against the plan, and facilitate communication of and commitment to the plan among members of the project team and ISD management.

Scope

This guideline should be used with the Software Project Planning processes (and aligns with the Project Monitoring and Control process) by all mission software projects.

Guideline

The following are in no particular order and are numbered for reference purposes only:

1. Each major deliverable software product within a project, such as S/C Attitude Control System, Telemetry & Command Ground System, or Planning & Scheduling System should have a separate WBS structure under the given mission project WBS. Each WBS may be tailored and constructed to reflect unique characteristics of each product effort as appropriate.
2. The WBS is a tree-structured, activity-oriented representation of the products and services needed to meet the requirements of the project. It provides a comprehensive and consistent framework for correlating material, services, schedules, staffing, and costs associated with organizing, planning, monitoring, controlling, and reporting the status of each work element of the project. See Addendum A for an example of WBS and Addendum B for an example of a WBS Dictionary. Also see Resources for a link to the Flight Software Branch (FSB) WBS Standard.
3. The WBS will be defined and refined during the project planning process. Initial software project planning will include the development of the high level WBS, which is defined before the schedule is developed, resources assigned, or costs estimated. As the planning process progresses, detailed scheduling, estimation, and costing will influence the decomposition of the initial WBS into lower level WBS elements.
4. Organize the specific work elements that must be accomplished into successively smaller work elements such that:
   a) The subdivisions (or decomposition) of work elements are referenced in terms of levels
   b) The highest levels usually reflect the major deliverable work areas or phases of the project
   c) Sub-divided to a sufficient level of detail (depth) to permit accurate

planning and monitoring without undue maintenance, data collection and reporting burden. High risk activities (or those requiring higher accuracy of planning and estimation) should be driven to a lower level of detail. A sufficient level of detail is usually at least one level lower than management reporting requirements

   d) Each WBS element summarizes all WBS elements below it
   e) Each WBS element has only one parent

5. Each element should have further explanatory information about it in a WBS Dictionary with task descriptions
6. All WBS elements should be aligned/compatible with organizational structures, time keeping, and accounting structures
7. A unique labeling scheme for each WBS element should be used that clearly denotes the hierarchical nature of the WBS
8. For each WBS element, document how completion of that element will be determined (i.e. a delivered product, a completed service)
9. To the extent possible, the WBS should be product/deliverable based – but do not forget other necessary tasks (e.g., reporting, integration) and processes (e.g., requirements management)
10. The WBS should be available to appropriate involved parties during planning – to solicit input **and** to document commitment
11. Remember: The WBS is not just for planning – consider how it will be used to facilitate reporting, monitoring, and controlling
12. Cost and schedule (earned value) data should be available for appropriate WBS elements/level (sufficient detail and "roll-ups"/summary, but not to the lowest level of the WBS)

Tools and Templates

The following tools are available. Others may exist for the local project.

Name	Description
FSB WBS Standard	General high level WBS applicable to all FSB Software Projects
Code 400 Project Plan Standard (including WBS)	Code 400 Standard Project Plan description and Project plan template
Code 400 WBS Dictionary (including WBS)	Code 400 WBS Formatted Dictionary
Code 400 WBS Standard	Code 400 WBS Standard (3 levels) – Included in Addendum example

Change History

Version	Date	Description of Improvements
1.0	June 20, 2005	Initial approved version by CCB

Addendum A
Example WBS

To demonstrate the manner in which work can be "broken-down":

Generic Example (with detail suppressed)
10. Project Management
10.1. General Management and Control Activities
10.1.1. Software Management Coordination
10.1.2. Software Management Plan
10.1.3. Work Implementation Plan
10.1.4. Tracking and Control
10.2. Risk Management
10.3. Arrange and Conduct Reviews
10.3.1. PDR + CDR + SRR / Technical Reviews
10.3.2. ….
10.3.3. BSR / Management Reviews
10.3.4. …..
10.4. Mission Assurance
10.4.1. Safety
10.4.2. Quality Assurance
10.4.3. Product Assurance
10.4.4. Materials/Processes
10.4.5. Software Assurance/IV&V
10.4.6. Reliability Analysis
10.5. General Documentation support (e.g., document reproduction)
10.6. Administrative Support includes contact with financial and procurement organizations
10.7. IT/Computer Support
10.7.1. Servers, network
10.7.2. Tools
10.7.3. Workstations
10.7.4. Shared workspace charges
10.7.5. System Administration
10.8. Data Management (Plan to capture and keep documents, reports, data, measures, actuals, status reports…)
10.9. Other Expenses
10.9.1. Training (includes technical training as well as institutionally-required training, e.g., ethics refreshers, IT security)
10.9.2. Travel (both programmatic and conference)
10.9.2.1. GSFC
10.9.2.2. Contractor
20. Systems Engineering
30. Hardware Analysis (Products should be plans and reports)
40. Software
41 - Software Design (Subcontractor)
42 – 4n - Build or Release (n-1) Development/Patch Releases
4n.1.. Build xx subsystem yy module zz
48 - Software Rework
49 - Software Documentation
50. Testing (System, End-to-End, Launch Simulations….)
60. User Training
70. Operations and Maintenance

Addendum B
Example WBS Dictionary

To demonstrate the descriptive text that can be associated with the WBS elements. Only some are shown.

WBS Levels			Title	Definition
L1	L2	L3		
20			**Systems Engineering**	All activities associated with systems engineering
	21		Requirements Analysis	Include activities related to the analysis of system (including hardware and software) requirements, preparation for the system requirements review (SRR), execution of the SRR, and generation of the system requirements specification (SRS). Keep this CA open until the baselining of the SRS. Also include activities related to the generation of other documents that may be required at SRR, including the development plan. Include a milestone for the completion of the software development estimation package following the SRR.
	22		Interface Definition	Include activities related to the analysis of system interfaces and preparation of associated ICDs. Plan this element only if such activity is expected to be significant. Otherwise, include interface definition as a separate work package in WBS element 21
	23-27		<Other System> Analyses	Include activities related to the performance of scheduled, large, well-defined (i.e., in the TA) analyses and studies (e.g., performance analyses, planning and scheduling studies). Products should be the <study name> plan or <analysis name> report. Create separate WBS elements, sub-divide them or combine them, depending on the resulting size of the elements.
	28		Sustaining Engineering	Include activities such as configuration change request (CCR) analysis, meeting support, additional requirements activities (i.e., post-SRR) not associated with a CCR, and small miscellaneous studies and analyses (particularly quick-reaction-type work). The products of this element may be updates to the SRS and ICDs, plans and reports, memoranda, etc. Also include preparation of the software development history. Do not include discrepancy report (DR) analysis in this element.
30			**Hardware Analysis**	Include activities related to the selection of hardware to be purchased, including development of hardware concepts and specifications, trade studies, acquisition plans, and installation and site preparation plans. Also include the activities related to the actual site preparation, installation, and checkout. Products should be plans and reports.
40			**Software**	All activities associated with software design and development
	41		Software Design	Create separate work packages for preliminary and detailed design. Keep this element open until the delivery of the detailed design document, typically a month after the critical design review (CDR). Include activities related to software design, preparation for the preliminary design review (PDR) and CDR, execution of the PDR and CDR, and generation of the design documents. Include design prototyping when applicable. For large tasks, consider creating separate elements for preliminary and detailed design. Include milestones for the completion of the work packages after PDR and CDR.
		41.1	Preliminary Design	Preliminary Design…

WBS Levels			Title	Definition
L1	L2	L3		
		41.2	Detail Design	Detail Design…
	42-4n		Build or Release (n-1) Development/Patch Releases	Create a separate WBS element for each build and/or release. Include activities related to unit design, code, test, and integration (i.e., activities typically shown on the trend charts) as well as, optionally, those related to the generation of release-related documentation, including user's guides, operations manuals, and updates to the detailed design document and build/release plan. Optionally, include activities related to DR and internal discrepancy report (IDR) analysis and resolution. Do not include activities or documentation related to independent testing. Include milestones at the start of each release for a build design review (BDR) and at the completion of each release for the completion of the software development report form and the actuals portion of the Estimation package
	48		Software Rework	Include activities related to the analysis and resolution of software problems (IDRs and DRs) if this work is not included in elements 42 - 4n.
	49		Software Documentation	Include activities related to the preparation of user, operations, and design documentation if this work is not included in elements 42 - 4n.